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EXPERIMENTS WITH DDT FOR THE CONTROL OF THE GYPSY MOTH, PARTICULARLY WITH AERIAL EQUIPMENT

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During 1945 a series of plots infested with the gypsy moth (Porthetria dispar (L.)) were sprayed with insecticides containing technical DDT applied either from the air or from the ground. The work was carried out as a cooperative project. The Division of Forest Insect Investigations was responsible for the general plan of experimentation. The Division of Gypsy and Brown-tail Moths Control applied the insecticides. Both these Divisions and the States of New York and Pennsylvania checked on results.

AIRPLANE APPLICATION

Two single-motor biplanes were used in the airplane experiments. Twenty-six plots were treated from a White Standard equipped with a 100-gallon supply tank and a spinner-disk distributing device, and eight plots with an N-3-N (Navy Trainer) equipped with a 60-gallon tank and a nozzle-type distributor. Each plane released about 16 gallons of liquid per minute distributed as a fine mist., Since the results with both planes were very similar, the effectiveness of the treatments is discussed under the various objectives for which the experiments were designed, regardless of the plane used. Very little foliage injury was observed which was attributable to spray deposits. A complete list of treatments, together with the egg-cluster counts in the spring before treatment and in the fall after treatment, is given in table 1.

Description of Plots

Plots for airplane spraying were laid out near Wendell and Athol, Mass., Saxtons River, Vt., Hope, N. Y., and Moosic and Spring Brook, Pa. They ranged in size from 10 to 173 acres, and presented a wide variety of flying conditions. Within each plot from 4 to 12 quarter acre areas were delineated in which the numbers of gypsy moth egg clusters were estimated before treatment and again in the fall after egg deposition was completed. The fall estimates were augmented by a survey conducted throughout the entire plot.

1/ Many workers participated in these experiments. Donald Whittam and Raymond Dion acted as pilots in the aerial work. Ralph Holbrook and David Crosby laid out plots, took egg-cluster counts, and took part in other phases of the work at Wendell and Athol, Mass., and Saxtons River, Vt. A. J. Pruett, R. L. Hardy, Roy Herbert, and John Regan did the plot work and rearing of larvae at Moosic and Spring Brook, Pa. Robert Sweet and others carried out the field work at Hope, N. Y.

Eighteen of the plots were laid out in the Wendell, Mass., State Forest. Each was 10 acres in area. They were too close together to be entirely satisfactory. The first applications demonstrated that spray intended for one plot might drift onto another and thus confound the results. Since this fact was recognized, however, it is believed that the results for each plot can be clearly defined.

As a check on the effect of an oil spray containing no DDT, one plot in the Wendell State Forest was treated with kerosene plus xylene mixed as in the regular formula containing these oils. Cloth trays placed in the plot to obtain an estimate of dead larvae falling to the ground indicated that very little mortality took place during or subsequent to the application.

Seasonal Infestation

The 1945 season was very unusual. Unseasonably warm weather in March and early in April caused one of the earliest general hatches on record. This was followed by several weeks of cold, rainy weather, during which the small larvae remained massed at or near the egg clusters for days at a time. On May 11 there was a snowfall of several inches, and many of the small caterpillars died. Later in the season "wilt" disease was prevalent at Wendell, Saxtons River, and Athol. Estimates of the egg clusters present on untreated check plots in the fall showed that the number had dropped to about one-third of those present in the spring. However, at Pittston, Pa., near Moosic and Spring Brook, the number of egg clusters on an untreated check plot increased fivefold. Spring conditions were comparable to those at Wendell, but little or no wilt was observed later in the season. There were no check plots under observation at Hope, N. Y., but the infestation was generally light.

Time of Application

The first four treatments in table I were applied on April 29. At that time about 75 percent of the egg clusters had hatched, the buds of oak were just bursting, and the leaves of gray birch and poplar were small. Hatching continued during most of May. The almost complete control effected with the 1- and 3-pound dosages of DDT indicates that these sprays are toxic to young gypsy moth larvae for a long time and that early spraying is a practical method of treatment. The remaining treatments were applied when larvae were in the first to fifth instars, and they gave excellent results. There was some survival, though, on four plots not included in this study, which were treated after pupation had begun. To be effective, therefore, sprays should be applied just before or during the larval period.

Coverage

It is important to determine the optimum volume of spray to apply per acre. The amount will vary with many different factors, including species of insect to be controlled and density of stand. Of equal importance is the evenness of spray distribution, which largely depends upon the distributing apparatus in use and the skill of the pilot.

The planes used in 1945 flew at about 80 miles per hour 50 feet above the treetops, and in almost all the experimental work distributed 16 gallons of spray per minute. To check the spray coverage and evenness of distribution, glass plates were placed in all the plots and a visual estimate was made of the amount of DDT deposited on them. The plates were usually placed at the corners of the 1/4-acre observation areas in a fairly open space.

The amount of insecticide released over a plot often differed considerably from the amount actually deposited within the plot. Evaporation, wind drift, and many other factors may have reduced the amount of spray. Furthermore, there may have been a wide variation in the evenness of distribution. It is therefore incorrect to state that a plot was treated with an exact amount of DDT per acre in an exact amount of spray, or to infer that a certain dosage was evenly distributed over an entire plot. Actually the correct figures are unknown. Nevertheless, a measure is necessary for comparative purposes, and the most convenient one to use is the amount of spray released.

On the 2 plots at Wendell treated with 1 pound of DDT in 1 2/3 gallons of spray per acre on April 29, before foliage was fully developed, a few gypsy moth larvae survived. Since the glass plates were almost completely covered with a light film of oil, the survival of a few larvae can hardly be attributed to a deficiency in the volume of spray applied. Twenty plots were sprayed, after foliage was fully developed, with 1/2 to 1 pound of DDT in 1 to 1 2/3 gallons of spray per acre. Since complete control[2/] was effected on 12 of them, there seems to be no doubt that sufficient spray was used to give adequate coverage. Therefore, the optimum volume of spray, for the 1945 distributing apparatus at least, was probably between 1 and 1 2/3 gallons per acre. Only 1 plot was treated with less than 1 gallon of spray per acre. This plot of 10 acres at Wendell was treated with 1/2 pound of DDT per acre, applied in 2 quarts of spray, the rate of discharge being cut to 8 gallons of spray per minute. As a result a considerably finer spray was released. The spray drifted more than usual, and at least a trace of spray deposit was recovered over about 25 acres. Effective control was confined to about 10 acres in the central portion of the area, and where only a trace of insecticide was deposited there was considerable survival of gypsy moth larvae.

Dosages

To establish the minimum dosage of DDT which will give complete control of the gypsy moth, it will, of course, be necessary to run several series of tests in which dosage is the only variable. Although it was impossible to run a complete series of this sort in 1945, posthatch

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2/ Complete control as used in this paper indicates that a thorough scouting of the area showed no new egg clusters.

treatments made on five plots offer a fair comparison. On each plot 1 gallon of spray was applied per acre, and in each case xylene was used as an auxiliary solvent for DDT, with kerosene as a diluent. The results are summarized in table 2.

Complete control of larvae was obtained at a dosage of 1 pound of DDT per acre, nearly complete control at dosages of 1/2 and 1/4 pound, and ineffective control at 1/8 pound per acre. With the 1/8-pound dosage the estimated number of egg clusters per acre was reduced from 1,906 in the spring to 309 in the fall. However, natural mortality in this area was high, and probably if the plot had not been treated there would not have been more than 600 new egg clusters per acre in the fall. The plot was exceptionally well sprayed, very little spray drifting out of the plot. New egg clusters were well distributed over the entire plot in the fall.

Among the 30 plots sprayed after the larvae had hatched, 4 were treated with less than 1/2 pound of DDT per acre, and at least a few new egg clusters were found on all of them. Of the 8 plots treated at the 1/2-pound dosage, complete control was effected on 5 plots and a single new egg cluster was found on each of 2 plots. On 1 plot at Moosic egg clusters were found in three widely separated areas, indicating incomplete spray coverage on those areas. Eleven plots were treated with 1 pound of DDT per acre, and new egg clusters were found on 3 of them. All 3 were sprayed under adverse weather conditions. Six plots were sprayed with more than 1 pound of DDT per acre, and complete control was effected on all of them.

Considering all these facts, the results indicate that, with the distributing apparatus used in 1945, complete control of the gypsy moth is almost always effected when DDT is applied at the rate of 1 pound in one or more gallons of oil spray per acre after hatching has occurred; also that complete control is frequently obtained at dosages as low as 1/2 pound per acre.

Formulations

The DDT formulations used in these tests were prepared as solutions in kerosene or fuel oil, with and without an auxiliary solvent, as an emulsion, and as a suspension. The two oil sprays used against the gypsy moth during 1945 appeared to be about equally effective. The emulsions and suspensions were somewhat less effective, but they were not adequately tested.

Almost complete control of the gypsy moth was effected on plots sprayed with 1 pound of DDT in 1 2/3 gallons of fuel oil or kerosene per acre before hatching was completed, and complete control was effected on plots sprayed with the same solutions after the larvae had hatched. Results with the two oils were very similar. Fuel oil dissolves somewhat more DDT than kerosene and is a little cheaper. Both solutions have much to commend them. The oils are easily procured and the price is reasonable. The solutions are easily mixed and they make effective sprays. They have some disadvantages. The oils dissolve comparatively little DDT and

they do not hold the insecticide in solution well at temperatures near freezing. The highest concentration of DDT used in kerosene or fuel oil was 1 pound of DDT in 1 2/3 gallons of oil, a 7.2-percent solution. The solutions were mixed indoors and stored in a warm building when necessary, and no difficulty was experienced from DDT crystallizing out.

Sprays made up by dissolving DDT in a solvent and adding kerosene as a diluent were used on 13 plots. The following solvents were used: Xylene (technical grade), Solvesso-Xylol, 3/, 4/, and two aromatic petroleum fractions Velsicol AR-50 and PD 544-C. 5/ Excellent control was obtained on all these plots except where the dosage of DDT was greatly reduced or weather conditions were particularly unfavorable. The experiments did not show that any one of the auxiliary solvents was superior to the others.

An auxiliary solvent is necessary if it is desired to use higher than 7 or 8 percent solutions of DDT in kerosene or fuel oil. This may be an advantage in that it permits the application of a given amount of the insecticide in a smaller volume of spray, and the DDT can be held in solution at lower temperatures. The disadvantages of an auxiliary solvent are the added cost of spray materials and difficulties encountered in mixing.

Four plots were sprayed with DDT mixed as an emulsion. Complete control was effected on two of them, in which xylene was used as a solvent and Igepal CA Extra (an alkyl aryl polyglycol ether) as an emulsifier, but only part of the larvae that were fed the sprayed foliage in laboratory trays were killed. One plot was sprayed with an emulsion using Mentor 25 4/ (a heavy aromatic petroleum fraction) as a solvent with Igepal CA Extra as an emulsifier. Only partial control was effected, probably because the leaves were wet when the spray was applied. The fourth plot was sprayed with a 25-percent emulsifiable DDT concentrate 6/. Unfortunately there was sufficient drift of spray material from a nearby plot sprayed with an oil solution of DDT to confound the results.

Only one plot was sprayed with a suspension of DDT. This was a 50-percent DDT water-dispersible powder. 6/ This plot was also affected by drift from a nearby plot sprayed with oil. Sprayed foliage (probably

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3/ In order to give an accurate report on the experiments, trade names are used in this paper. Their use does not imply endorsement, guarantee, or warranty of the materials so mentioned, or that other similar, untested products may not be used in the same manner with equal results.

4/ Product of the Colonial Beacon Oil Co.

5/ Product of the Socony-Vacuum Oil Co.

6/ Experimental products of the E. I. du Pont de Nemours and Co., Inc.

unaffected by drift) caused 100 percent mortality of larvae held in laboratory trays.

Weather Conditions

No particular study was made regarding the influence of climatic factors on the efficiency of the airplane sprays. Nevertheless, the experiments showed that oil sprays containing DDT could be satisfactorily sprayed on wet foliage, and that, even when heavy rains occurred soon after the sprays were applied, sufficient residues remained to effect complete or nearly complete control of the gypsy moth. Three examples may be mentioned:

(1) The prehatch spraying was completed at 8:30 a.m. on April 29. At 11:40 there was a light shower and it was followed by another late in the afternoon. From May 1 through May 19 there were nine rainy days with a total precipitation of 6.9 inches. Throughout this period gypsy moth egg clusters were hatching.

(2) On June 16 a 66-acre plot at Moosic, Pa., was sprayed at the rate of 1/2 pound of DDT in 1 2/3 gallons of fuel oil per acre. Foliage was so wet at the time of application that as the plane was flown over the plot the down-draft from the propeller caused a heavy fall of water from the leaves. A few seconds later the fine mist spray of insecticide could be seen drifting down. In the fall only one new egg cluster was found within the plot.

(3) On June 19 a 25-acre plot at Saxtons River, Vt., was sprayed at the rate of 1 pound of DDT in 1 1/2 gallons of spray per acre. PD 544-C was used as an auxiliary solvent and kerosene as a diluent. Foliage was wet when sprayed, and a few hours after the spraying there was a heavy downpour with 1 1/2 inches of rainfall. When the plot was surveyed in the fall, only one new egg cluster was found.

Larval Mortality

On all plots sprayed with DDT after hatching was completed the larvae were killed more quickly than where lead arsenate is used. Eight cloth-covered trays, 3 feet square, were put out in each plot to obtain some idea of the number of dead larvae falling to the ground. Results on one of the plots in the Wendell State Forest are considered typical. A total of 835 dead larvae were recovered; 72 percent of these were recovered the first day, 87 percent the first 3 days, 99 percent the first 8 days, and none 12 days after treatment. Most of the larvae recovered several days after the treatment had been dead for some time but had lodged in the foliage.

Foliage from each of the treated plots was collected and placed in trays with healthy larvae, usually 50. The results may be summarized as follows:

(1) Very little feeding was done by larvae affected by DDT.

(2) Foliage from almost all plots treated with oil sprays at 1 pound of DDT per acre caused complete mortality of larvae even after long periods of weathering and heavy rainfall.

(3) Foliage from plots treated with oil sprays at 1/4 and 1/2 pound of DDT per acre caused complete mortality of larvae when the foliage was collected before it was exposed to rainfall, but mortality was incomplete after the foliage had been exposed to weathering, and the percentage of mortality decreased as the length of the weathering period increased.

(4) Foliage from plots sprayed with DDT emulsions at the rate of 1 pound per acre caused rather low mortality 9 and 20 days after treatment.

(5) Foliage from a plot sprayed with DDT in suspension at the rate of 1 pound per acre caused complete mortality of larvae 18 days after treatment.

(6) Foliage from a plot treated with xylene plus kerosene but no DDT caused no mortality.

(7) In check trays of larvae fed untreated foliage the mortality was very low.

APPLICATIONS FROM THE GROUND

All experimental work in the application of DDT against the gypsy moth, using ground equipment, was carried out in the Green Run area of Spring Brook Township, Pa. Eight 1-acre plots were sprayed with a power sprayer and two with knapsack fire pumps. The objective was to determine the minimum dosage of DDT that would give satisfactory control when applied as an emulsion with a power sprayer, both before and after hatch, and whether satisfactory control could be obtained by treating the forest floor and tree trunks up to a height of 5 or 6 feet.

Power Sprayers

Four plots were treated on April 18 and 19. At that time many of the larvae had hatched, but most of them were still on the egg clusters. The four plots were sprayed with 1/4 to 1/2 pound of DDT per 100 gallons of tank mix at dosages of 1 1/2 to 3 pounds of DDT per acre. Complete control was effected on all plots, but undoubtedly they were all "oversprayed."

Three plots were treated on June 7 and a fourth on June 13, when larvae were in the fourth and fifth instars. These tests are summarized in table 3.

A striking correlation exists between the reduction in numbers of egg clusters and the increase in dosage of DDT. A dosage of 1 pound per acre is apparently necessary to effect complete control, but a considerable reduction in infestation was effected when only 2 ounces (0.125 lb.) of DDT were applied per acre.

Knapsack Fire Pumps

Two 1-acre plots were treated on April 19 with hand-operated fire pumps that produced a fine-mist spray up to about 6 feet above the ground. Probably 95 percent of the egg clusters on these plots were below this height. Hatching had commenced at the time, and a few larvae were observed on the foliage. One plot was treated with 2.3 pounds of DDT mixed as an emulsion in 23 gallons of spray, and the other with 5 pounds of DDT in 10 gallons of light oil. Very striking, although incomplete, control was effected on both plots. The estimated number of egg clusters was 3,223 in the spring and 70 in the fall on the plot treated with the emulsion and 1,725 in the spring and 17 in the fall on the plot treated with oil.

DISCUSSION

DDT and the development of airplane applications of insecticides provide new and powerful tools for use against the gypsy moth. One important advantage in using DDT is the low cost of the material. Since 1 pound of DDT will give effective control on an acre of woodland, the cost of the spray materials per acre is about one-fifth that of the materials used in the hitherto conventional method of treatment with power sprayers, which requires 30 pounds of lead arsenate and 6 pints of fish oil per acre.

The use of DDT also doubles the length of the period during which spraying can be done effectively. Prehatch sprays are practical and afford an opportunity for excellent coverage before the buds burst; wet foliage does not interfere seriously with the residual toxicity of the insecticide; and, since DDT is a contact insecticide, applications can be made up to the time of pupation. Lead arsenate, on the other hand, cannot be satisfactorily applied until the leaves are well developed; wet foliage delays applications considerably; and sprays applied late in the season are relatively ineffective because larvae pupate before consuming a lethal dose of the insecticide.

The practicability of spraying DDT on tree trunks and undergrowth with hand-operated pumps is also a distinct advantage over the use of power sprayers in small, isolated, or special infestations. The advantages of airplane applications over spraying with a power sprayer are obvious. At best a ground crew can spray only about 200 acres of woodland a season. A pilot, operating one of the planes in use during 1945, can probably treat about 10,000 acres a season.

DDT can be harmful to fish, wildlife, and beneficial insects when used indiscriminately. It should be applied over extensive forest areas only under competent supervision. On the basis of present information a dosage of 1 pound or less per acre will not cause serious or lasting damage, except possibly to fish and other aquatic life.

SUMMARY

During 1945 a series of plots infested with the gypsy moth (Porthetria dispar (L)) were sprayed with DDT insecticides applied either from the air

or from the ground. Twenty-six plots were treated with a White Standard biplane equipped with a spinner-disk distributing device and eight plots with an N-3-N biplane equipped with a nozzle-type distributing device. Results were similar with both planes.

Early sprays applied before gypsy moth hatching was completed effected almost perfect control when 1 pound of DDT was distributed in 1 2/3 gallons of kerosene or fuel oil per acre. Oil sprays applied after hatching was completed almost always effected perfect control when 1 pound of DDT was distributed in 1 to 1 2/3 gallons of spray per acre, and frequently when 1/2 pound was distributed. A dosage of 1/8 pound per acre effected only partial control. The two oil sprays appeared to be about equally effective, and there seemed to be no difference in results when any one of several auxiliary solvents was combined with kerosene. The oil sprays were effective when sprayed on wet foliage or when heavy rains occurred soon after application. On most plots a high proportion of the larvae that died succumbed within a few days after the spray was applied. Foliage from all plots treated with DDT-oil sprays caused heavy mortality of healthy caged larvae even after long periods of weathering. Oil sprays containing no DDT caused practically no larval mortality. The cost of spray materials, when 1 pound of DDT was distributed per acre, for the mixtures used experimentally in 1945, was about one-fifth that of the conventional treatment with lead arsenate and fish oil.

Eight 1-acre plots were sprayed from the ground with a power sprayer. On four of them, sprayed just as larvae were hatching, complete control was effected with dosages of $1\frac{1}{2}$ to 3 pounds of DDT per acre, but undoubtedly the plots were "oversprayed." The other four were sprayed with dosages of 1/8, 1/4, 1/2, and 1 pound of DDT per acre when larvae were in the fourth and fifth instars. Mortality was complete with the 1-pound dosage. Survival on the other plots was closely correlated with dosage, and there was a considerable reduction in infestation when only 2 ounces of DDT were applied as an emulsion in 525 to 600 gallons of water per acre.

Two 1-acre plots were sprayed with hand pumps which produced a fine-mist spray up to about 6 feet above the ground. The spray was applied just as egg clusters were hatching. One plot was sprayed with an emulsion and the other with an oil spray. The gypsy moth population was greatly reduced on both plots, but control was incomplete.

DDT and the development of airplane application provide new and powerful means of combating the gypsy moth. DDT is a more efficient and a cheaper spray than lead arsenate. Only about 200 acres of woodland can be treated during a season with a power sprayer, whereas about 10,000 acres can be treated with a small plane similar to those used in 1945.

Dosage per acre		Accessory material	Plot location	Size of Plot	Egg clusters	
DDT	Spray				Before treatment (per acre)	After treatment
Pounds	Gallons			Acres	Number	Number
		Plots treated before hatching was fully completed				
1	1 2/3	No. 2 Fuel oil	Wendell, Mass.	10	6,189	2 (on whole plot)
	1 2/3	Kerosene	do.	10	2,251	2 (on border)
3	5	No. 2 Fuel oil	do.	10	10,708	7 (on border)
	5	Kerosene	do.	10	5,463	3 (on border)
		Plots treated after hatching was completed				
1/8	1	Kerosene plus xylene	Wendell, Mass. 1/	10	1,906	Common over whole plot (309 per acre)
1/4	1 2/3	No. 208 Diesel fuel oil	Moosic, Pa. 1/	53	780	5 (on whole plot)
	1 2/3	Kerosene	do. 1/	67	944	Several groups of 1-10 egg clusters
	1	Kerosene plus xylene	Wendell, Mass.	10	4,229	4 (on border)
1/2	1	No. 2 fuel oil	Hope, N. Y.	37 1/2	23	None
	1 2/3	No. 208 Diesel fuel oil	Moosic, Pa. 1/	66	1,171	1 (on whole plot)
	1	Kerosene	Hope, N. Y.,	45	44	None
	1 2/3	do.	Moosic, Pa. 1/	96	605	150 in 3 groups
	1/2	Kerosene plus xylene	Wendell, Mass.	10	4,229	None
	1	do.	do.	10	6,225	None
	1	do.	Hope, N. Y.	62 1/2	31	1 (on whole plot)
	1	Kerosene plus Velsicol AR-50	do.	62 1/2	46	None
7/10	1	25 percent DDT emulsifiable concentrate	Wendell, Mass.	10	4,646	Undetermined, affected by spray drift.
1	1 2/3	No. 2 Fuel oil	Wendell, Mass.	10	4,320	None
	1 2/3	do.	Hope, N. Y.	45	181	Do.

Table 1.---(Continued)

Dosage per acre		Accessory material	Plot location	Size of plot	Egg clusters	
DDT	Spray				Before treatment (per acre)	After treatment
Pounds	Gallons			Acres	Number	Number
		Plots treated after hatching was completed				
1	1 2/3	Kerosene	Wendell, Mass.	10	4,646	None
	1 2/3	do.	Hope, N. Y.	37 1/2	50	Do.
	1	Kerosene plus xylene	do.	42 1/2	118	Do.
	1 1/2	Kerosene plus Solvesso-xylol	Moosic, Pa. 1/	34	853	150 on west and south sides
	1	Kerosene plus Velsicol AR-50	Hope, N. Y.	42 1/2	164	None
	1 1/2	Kerosene plus PD-544C	Saxtons River, Vt.	25	3,013	1 (on whole plot)
	1	Xylene plus Igepal C.A. Extra plus water	Wendell, Mass.	10	2,995	None
	1 1/2	Mentor 25 plus Igepal C.A. Extra plus water	Saxtons River, Vt.	25	2,614	35 (on whole plot)
	1	50 percent DDT water dispersible powder	Wendell, Mass.	10	1,652	Undetermined, affected by spray drift
1 1/4	1 1/2	Kerosene plus Solvesso-xylol	Athol, Mass.	40	6,500	None
2	2	Horticultural Spray Base Heavy Oil plus xylene	Spring Brook, Pa.	173	2,250	Do.
3	3	Kerosene plus xylene	Wendell, Mass.	10	2,450	Do.
	3	Kerosene plus Velsicol AR-50	do.	10	3,104	Do.
	3	Kerosene plus Igepal CA Extra plus water	do.	10	3,539	Do.

Table 1.--(Continued)

Dosage per acre		Accessory material	Plot location	Size of plot	Egg clusters	
DDT	Spray				Before treatment (per acre)	After treatment
Pounds	Gallons			Acres	Number	Number
		Plots treated after hatching was completed				
5	5	Shell Horticultural Spray Base Heavy Oil plus xylene	Spring Brook, Pa.	97	800	None
No DDT	3	Kerosene plus xylene	Wendell, Mass.	10	3,721	1,234 (per acre)
Checks (no treatment)			do.	10	3,376	944 (per acre)
			Pittston, Pa.	20	272	1,361 (per acre)

1/ Sprayed with N-3-N, in all other plots the White Standard was used.

Table 2.--Effectiveness of airplane sprays containing different dosages of DDT against the gypsy moth.

Plot location	Dosage of DDT per acre	Larval instar at time of treatment	Results
	Pounds		
Wendell, Mass.	1/8	3 and 4	Slight control
	1/4	2 and 3	4 new egg clusters found along roadside border
	1/2	1	Apparently complete control on sprayed are
Hope, N.Y.	1/2	2 and 3	1 new egg cluster found
	1	2 and 3	Complete control

Table 3.--Egg cluster counts on 1-acre plots treated with DDT applied from the ground by a power sprayer

DDT in 100 gallons of tank mix	Composition of spray quantities per acre				Estimated clusters per acre	
	DDT	Velsicol AR-50	Igepal CA Extra	Water	Before treatment	After treatment
Ounces	Pounds	Pints	Pints	Gallons	Number	Number
0.33	0.125	0.31	0.02	600	1063	436
.68	.22	.55	.03	525	1673	122
1.36	.46	1.15	.07	550	1446	17
2.72	1.02	2.55	.16	600	2579	None
Checks (no treatment)		--	--	--	105	558
--	--	--	--	--	1533	4234